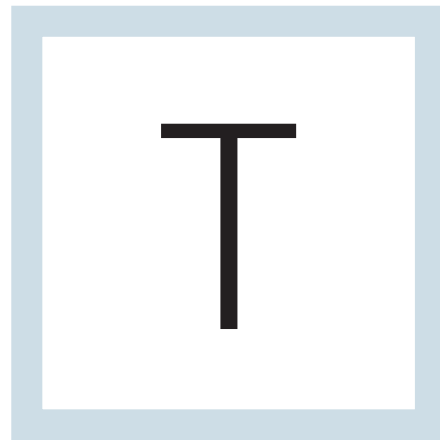


➤ **Turning Data into a Tool: Data  
Visualization Best Practices**

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Visualization tools  
critical to big data  
decisions but still  
immature

In 'big data'  
visualization, seeing  
is believing -- but is  
that good?



**TO MAXIMIZE THE** value of big data, analysts need clear visualization of the data they're dealing with. In this e-guide, analytics guru Tom Davenport offers valuable insight on why visualization tools are a must-have in the big data age. Additionally, explore the most common challenges in creating a visually comprehensive and analytically-sound tool.

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Visualization tools critical to big data decisions but still immature

In 'big data' visualization, seeing is believing -- but is that good?

## VISUALIZATION TOOLS CRITICAL TO BIG DATA DECISIONS BUT STILL IMMATURE

*Linda Tucci, Executive Editor*

**Keeping Up with the Quants:** Your Guide to Understanding and Using Analytics is analytics guru Tom Davenport's latest exploration of big data and analytics. Due out in June, the book offers a management primer on surviving what Davenport and co-author Jinho Kim call "the quantitative information age."

In part 1 of our New Books interview, Davenport talked about the importance of seeing data as a means of influencing business decisions. In this second part, he expands on the means to this end, discusses why visualization tools are critical but still quite under-developed -- and, oh yes, surmises that one day soon, we'll all need to become YouTube directors.

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## WHAT IS THE FUNDAMENTAL PROBLEM WITH COMMUNICATING ANALYTICS?

**Tom Davenport:** A lot of people are not that quantitatively oriented. And let's face it, analytics can be very complicated, both from a statistical and mathematical perspective and in converting that implication into action. It is not an easy thing to do. Our educational institutions have not helped us out too much in that regard, in that they don't really spend a lot of time teaching people how to describe or translate analytics for decision makers. Even on the visual side, my impression is there is not even a clear inventory of what are the possible ways to display analytics visually.

**YOU GIVE TWO INTERESTING EXAMPLES OF HOW DATA VISUALIZATION -- OR LACK THEREOF -- CAN MATTER GREATLY IN DISSEMINATING IMPORTANT IDEAS: FLORENCE NIGHTINGALE, WHO USED PIE CHARTS TO COMMUNICATE HER FINDINGS ON INFECTION AND WON GREAT ACCLAIM, AND GREGOR MENDEL, THE FATHER OF MODERN GENETICS, WHOSE WORK WENT UNRECOGNIZED FOR DECADES IN PART BECAUSE OF ITS OBSCURE PRESENTATION.**

**Davenport:** I thought some classical mentions might help people see this is a longstanding problem. I heard recently of another example involving Alfred Russel Wallace, who was a biologist of sorts at the same time that Charles

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Darwin was around. Wallace came up with very similar solutions of evolution and natural selection, and his book actually came up before Darwin's did but didn't get the attention it deserved, largely for reasons of PR. I have concluded that our scientists, statisticians and mathematicians all need PR people to work with them now.

## IS THE REASON THAT DATA VISUALIZATION IS SO IMPORTANT TO COMMUNICATING IDEAS BECAUSE WE ARE VISUAL CREATURES, OR IS THERE SOMETHING SPECIAL ABOUT DATA IN A VISUAL FORM, AS OPPOSED TO WRITTEN WORDS OR AUDITORY STREAMS?

**Davenport:** I think visual presentation is powerful for a lot of people. We are all, I guess, except for the blind, visual creatures. But some people interact better with text and even numbers than [with] visual. I don't know -- and I am not sure anybody knows -- what the distribution of preferences is, but I know I am not much generally a visual person. I'd rather see a narrative-based description. I think in many cases we benefit from multiple ways of telling a story visually and in terms of narrative, so you want to have as many going on as possible in order to find one that engages the consumer.

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**I WAS WONDERING WHETHER THE FACT THAT A PICTURE CAN CONVEY SO MANY POINTS OF DATA AT ONCE -- PARALLEL STREAMS OF INFORMATION -- SOMEHOW MAKES IT MORE EFFECTIVE FOR A LOT OF, IF NOT ALL PEOPLE.**

**Davenport:** Again, I would say that it is all very contingent. As we know, there are good visuals and there are bad visuals, and we've all seen a lot of bad visuals in PowerPoint, for example. Edward Tufte has made a pretty good living demonstrating there are really bad approaches to visuals that often occur in PowerPoints. I think we are probably a lot farther along in the world of narrative -- we've been doing that for thousands of years -- than we are in visual displays of information. I think we are really just finding our way now.

I read an interview with Amanda Cox, who is a statistician by background and who does interactive graphics for The New York Times. She basically said we don't know very much about what we're doing. Design doesn't seem to provide a huge amount of insight to visual analytics. She says that she tends to find that people trained in computer science are the best at it, which I found somewhat surprising. So, I think we're in [the] really early days of knowing what the best approaches are and what kinds of skills are necessary to excel at the visual display of information.

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## WHAT ABOUT SOME OF THE VISUALIZATION TOOLS OUT THERE -- ARE THEY UP TO THE TASK?

**Davenport:** First of all, there is rapid change in these visual tools. You have companies like Tableau that are very popular now that were not popular at all five years ago. I think it is very confusing to CIOs and to people who have to make software selections, because you have some tools from SAS and IBM, which are traditionally good at statistical analysis but focus less on visual display, and then you have tools like Tableau and Spotfire that were much more oriented to visual display and less oriented to statistics. And now everybody is trying to augment those specialties: SAS has a new visual analytics approach, and Spotfire has a new statistical set of capabilities that they acquired. It is a just a very confusing landscape right now for people trying to make decisions.

It's hard to find instruction in this -- I don't know that there is an educational program anywhere in visual analytics. There's computer science and there's statistics and there's design, but it's the combination that we need now.

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## FINAL QUESTION: IN ALL YOUR RESEARCH, WHAT EXAMPLE OF COMMUNICATING ANALYTICS BLEW YOU AWAY?

**Davenport:** I think probably the example of using video to illustrate analytics. This was a pretty straightforward financial reporting application, but the idea that they would augment it with a very creative video story is probably the way we're going to do things in the future.

If you look at how we are persuaded to do other things, to buy products, to amuse ourselves -- think of all the clever cat videos people watch on YouTube these days -- it can't be very long until we get into the approach of communicating the results of analyses through video. So, we've got to become, not so much reporters or game designers, but all become video directors if we're going to be good at this.



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## IN 'BIG DATA' VISUALIZATION, SEEING IS BELIEVING -- BUT IS THAT GOOD?

*Linda Tucci, Executive Editor*

If a pile of data falls in a forest and nobody sees it, does it really exist? “From my point of view, data do not exist if you cannot see them.” Those were Andrew Pandre’s words, heavily accented, underscoring data as the plural of datum. Appropriately so, and not just because it’s grammatically correct, I should add, since the topic of the morning was “big data” visualization.

The Russian émigré -- a data scientist of many years, author of a popular blog and a principal at Sears Holding Cos. -- was among a panel of technologists at a local seminar last week on the value of visualization in understanding big data. Human understanding, to be clear, for the recurring theme of the panel (which included IBM Fellow Irene Greif, director of the IBM Center for Social Business; Martin Leach, CIO of the Broad Institute; and Richard Dale of Big Data Boston Ventures, an early stage investment firm) was that we humans like to look. Data is best apprehended through the visual system, our strongest sense.

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If we can't see the data, get a feel for it, if we can't detect some cluster or outlier, big data is not worth talking about, the panel said in so many words. "People have behavioral changes when they have visualizations in front of them. They interact and get drawn in, and start to learn things they wouldn't have learned if they were just told what others found," said Grief, based on her experience with IBM's Many Eyes data visualization tool. Visualization gives people a common language to probe complex ideas. "It creates a place where you can talk and communicate over the data," said Leach, who, with 13 petabytes of spinning disks under his purview at the Broad Institute, is no stranger to the problems posed by big data.

Visualizing data gives people a sense of ownership of the data, Pandre said. Bosses especially. Business people will ignore all the mathematical and statistical models unless they see "a freaking pie chart." Seeing is believing. "My role is to make people see the data and sense the data and make them act on what they see."

But how and who can do this when "80% of big data visualization is data, 10% is the story behind it and only a very small part is the actual visualization," according to Pandre. Understanding how to abstract and represent abstraction is probably the biggest challenge in big data visualization, said IBM's Greif, as

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much art as science. The ability to combine art with science is the key to visualizing data, but those talents rarely reside in one person. The Broad Institute's Leach told the story of a professor of dermatology at Yale who used to send his students to the Peabody Museum on campus and assign them an art work to describe. If they mastered that, they could describe "what the zit looked like."

Most big data visualization is confusing or worse, misleading: "85%, 90% of visualization is bad," Pandre said. And bad on many levels, the panel made clear, from choosing the wrong colors to represent findings (stick to green, red and yellow for good, bad and transitional data) to serious abuses. One practice that horrified Leach in his days working in big pharma was the researchers' habit of leaving off the error bars that show significant statistical differences between the bits of data in order to get their point across. "We need to caution people that visualization should be used for hypothesis formulation," Greif said. "We need to teach people to look at these charts and to know whether they are really learning something or getting a good idea to check on later." People don't necessarily have to be mathematicians, but they need to understand what led to the visualization.

And that becomes harder to do as the data gets bigger. Big data visualization summarizes and aggregates data, hopefully in illustrative ways, panel

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moderator Dale said, but begs the question of what gets lost in the details. And how much data can a person see in one go, anyway? “The human eye can only recognize a certain number of objects, and it is not millions,” Pandre said. Adding motion to a data point -- making it jiggle -- adds another dimension to the data humans can detect. “But I don’t think it is highly leveraged” as a tool, he said.

Humans are good at detecting change. One of Pandre’s early big data projects was analyzing the Soviet sky, taking a photo of it every second and analyzing the pictures, square by square, for any change in the scene -- a shadow of a cloud, an American plane. The ability to detect change, however, may be on a spectrum.

The Broad Institute’s Leach explained that for him, change is visceral: “I have Asperger’s to some degree. I also have OCD,” he said, using the acronym for obsessive compulsive disorder. “I feel uncomfortable in certain situations when I see certain things,” he said: an eagle in a tree by the side of the highway that no one else noticed, for example. The sign in the back of the seminar room was driving him crazy because it was off-kilter. “Certain people can notice changes; something in them makes them sense change differently.”

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